CLAIMS

What is claimed is:

1. A conformationally flexible cationic conjugated polymer comprising at least one angled linker having bonds to its two adjacent polymeric units which form an angle of less than about 155° with respect to one another and comprising multiple cationic groups in said polymer.

2. The polymer of claim 1, wherein the angle is less than about 145°.

3. The polymer of claim 1, wherein the angle is less than about 135°.

4. The polymer of claim 1, wherein the angle is less than about 125°.

5. The polymer of claim 1, wherein the angle is about 45° or more.

6. The polymer of claim 1, wherein the angle is about 60° or more.

7. The polymer of claim 1, wherein the monomeric unit has an optionally substituted structure selected from the group consisting of 1,2-benzene, 1,3-benzene, 1,2-naphthalene, 1,3-naphthalene, 1,6-naphthalene, 1,7-naphthalene, 1,8-naphthalene, 1,2-anthracene, 1,3-anthracene, 1,6-anthracene, 1,7-anthracene, 1,8-anthracene, and 1,9-anthracene, 2,3-biphenyl, 2,4-biphenyl, 2,6-biphenyl, 3,3'-biphenyl, 3,4-biphenyl, 3,5-biphenyl, 2,2'-biphenyl, 2,3'-biphenyl, 2,4'-biphenyl, and 3,4'-biphenyl, and wherein said monomeric unit is optionally substituted with one or more heteroatoms.

8. The polymer of claim 1, wherein the polymer is soluble in a predominantly aqueous medium.

9. The polymer of claim 1, wherein the polymer is soluble in water.

10. The polymer of claim 1, wherein the polymer comprises at least 1 mole percent of said monomeric unit.

11. The polymer of claim 1, wherein the monomeric unit introduces a torsional twist into the polymer.

12. The polymer of claim 1, wherein the polymer is a copolymer.

13. The polymer of claim 1, wherein the polymer is a block copolymer.

14. The polymer of claim 12, wherein the monomeric unit is incorporated randomly.

15. The polymer of claim 12, wherein the monomeric unit is incorporated periodically.

16. The polymer of claim 12, wherein the monomeric unit is incorporated in a block.

17. A library of compounds comprising a plurality of structurally different conjugated cationic conformationally flexible polymers, each of said plurality comprising an aromatic monomeric unit having bonds to its two adjacent polymeric units which form an angle of less than about 155° with respect to one another.

18. An article of manufacture comprising the conformationally flexible polymer of claim 1.

19. The article of claim 18, wherein the article is selected from the group consisting of an optical component, an electrical component, an optoelectronic device, a biosensor, a photodiode, a light-emitting diode, an optoelectronic semiconductor chip, a semiconductor thin-film, a polymeric photoswitch, an optical interconnect, a transducer, a lasing material, and a liquid crystal.

20. A method for screening for a conformationally flexible cationic conjugated polymer, comprising performing a functional assay on a plurality of structurally different polymers, wherein each of said plurality has a structure according to claim 1, and determining whether any of said polymers have a desired functional property.

21. The method of claim 20, wherein said functional property is increased fluorescence efficiency.

22. The method of claim 20, wherein said functional property is decreased self-quenching.

23. The method of claim 20, wherein said functional property is selected from absorbance wavelength and emission wavelength.

24. The method of claim 20, wherein said functional property is the ability to bind to a biological molecule.

25. An assay method comprising:

providing a sample that is suspected of containing a target molecule;

providing a conformationally flexible cationic conjugated polymer (CCP) that upon excitation is capable of transferring energy to a signaling chromophore, said CCP comprising an aromatic monomeric unit having bonds to its two adjacent polymeric units which form an angle of less than about 155° with respect to one another;

providing a sensor molecule that can bind to the target molecule, wherein a greater amount of emitted light is produced from the signaling chromophore upon excitation of the CCP in the presence of target;

contacting the sample with the sensor and the CCP in a solution under conditions in which the sensor can bind to the target, if present;

applying a light source to the solution that can excite the CCP; and

detecting whether the light emitted from the signaling chromophore is increased in the presence of the sample.

26. The method of claim 25, wherein the sample is contacted with the sensor and the CCP in the presence of a sufficient amount of an organic solvent to decrease hydrophobic interactions between the sensor and the CCP.

27. The method of claim 25, wherein the signaling chromophore is a fluorophore.

28. The method of claim 25, wherein the target is DNA.

29. The method of claim 25, wherein the target is RNA.

30. The method of claim 25, wherein the target is a protein.

31. The method of claim 25, wherein the target is a polynucleotide that is produced via an amplification reaction.

32. A target sensing solution comprising:

a signaling chromophore; and

a conformationally flexible cationic conjugated polymer (CCP) that is capable of transferring energy to the signaling chromophore upon excitation when brought into proximity thereto, said CCP comprising an aromatic monomeric unit having bonds to its two adjacent polymeric units which form an angle of less than about 155° with respect to one another, wherein a greater amount of energy can be produced from the signaling chromophore in the presence of the target being sensed when the CCP is excited.

33. The target sensing solution of claim 32, wherein the signaling chromophore is a polynucleotide specific dye.

34. The target sensing solution of claim 32, wherein the signaling chromophore is a fluorophore that is conjugated to a sensor biomolecule.

35. A kit for assaying a sample for a target biomolecule comprising:

a sensor biomolecule that can bind to the target biomolecule;

a signaling chromophore;

a conformationally flexible cationic conjugated polymer (CCP) that is capable of transferring energy to the signaling chromophore upon excitation when brought into proximity thereto, said CCP comprising an aromatic monomeric unit having bonds to its two adjacent polymeric units which form an angle of less than about 155° with respect to one another, wherein said sensor interacts with the CCP and a detectibly greater amount

of emitted light is produced from the signaling chromophore upon excitation of the CCP in the presence of target; and

a housing for retaining the reagents of the kit.

36. The method of claim 25, wherein the method is performed on a substrate.

37. The method of claim 29, wherein the substrate is selected from the group consisting of a microsphere, a chip, a slide, a multiwell plate, an optical fiber, an optionally porous gel matrix, a photodiode, and an optoelectronic device.

38. The method of claim 25, further comprising contacting the sample in a solution with the sensor, the CCP and a second signaling chromophore that can absorb energy from the signaling chromophore in the presence of target and emit light, and wherein detecting whether the light emitted from the signaling chromophore is increased in the presence of the sample comprises detecting whether the light emitted from the second signaling chromophore is increased in the presence of the sample.

39. The method of claim 38, wherein the second signaling chromophore is a polynucleotide-specific dye.

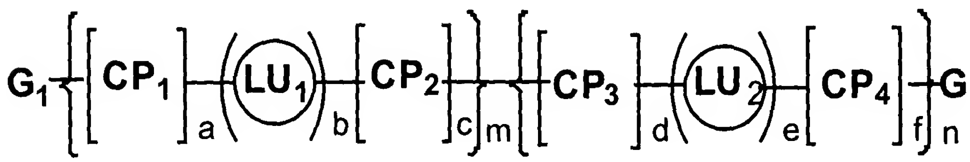
40. A signaling complex formed by the method of claim 25.

41. A sensing complex comprising:

a sensor biomolecule that can bind to a target biomolecule, said sensor attached to a signaling chromophore;

the conformationally flexible cationic conjugated polymer (CCP) of claim 1, wherein the CCP is capable of transferring energy to the signaling chromophore upon excitation when brought into proximity thereto, wherein said sensor biomolecule interacts with the CCP and emitted light can be produced from the signaling chromophore upon excitation of the multichromophore in the absence of target, and wherein a greater amount of emitted light is produced from the signaling chromophore upon excitation of the CCP in the presence of the target.

42. The polymer of claim 1, wherein said polymer has the structure:



wherein:

CP_1, CP_2, CP_3 and CP_4 are optionally substituted conjugated polymer segments or oligomeric structures, and may be the same or different from one another;

LU_1 and LU_2 are angled linkers forming bond angles to two adjacent polymeric units of less than about 155°, and can be mono- or polycyclic optionally substituted aryl groups having 5 to 20 atoms;

CP_1, CP_2, CP_3, CP_4, LU_1 and LU_2 are each optionally substituted at one or more positions with one or more groups selected from $-R_1$-A, $-R_2$-B, $-R_3$-C and $-R_4$-D, and may be attached through bridging functional groups -E- and -F-, with the proviso that the polymer as a whole must be substituted with a plurality of cationic groups;

R_1, R_2, R_3 and R_4 are independently selected from alkyl, alkenyl, alkoxy, alkynyl, and aryl, alkylaryl, arylalkyl, and polyalkylene oxide, each optionally substituted, and which may contain one or more heteroatoms, or may be not present;

A, B, C and D are independently selected from H, -SiR'R"R''', $-N^+$R'R"R''', a guanidinium group, histidine, a polyamine, a pyridinium group, and a sulfonium group;

R', R'' and R''' are independently selected from the group consisting of hydrogen, C_{1-12} alkyl and C_{1-12} alkoxy and C_{3-10} cycloalkyl;

E and F are independently selected from not present, -O-, -S-, -C(O)-, -C(O)O-, -C(R)(R')-, -N(R')-, and -Si(R')(R'');

X is O, S, Se, -N(R')- or -C(R')(R")-;

Y and Z are independently selected from -C(R)= and -N=;

m and n are independently 0 to about 10,000, wherein $m + n > 1$;

b and e are independently 0 to about 250, wherein $b + e > 1$;

a, c, d and f are independently 0 to about 250; and

G and G1 are capping units and may be the same or different, and are selected from activated units that allow further chemical reaction to extend the polymer chain, and nonactivated termination units.